ELECTRONICS FOR MEASUREMENT •COMPUTATION •TELEMETRY •CONTROL

INSTRUCTION MANUAL
for
CRYSTAL OSCILLATOR
AND
LINE DRIVER AMPLIFIER
MODEL GXA -1

DCS DATA-CONTROL SYSTEMS INC.
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ERRATA

MODEL GXA-1 MANUAL

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ERRATA NO: 2 (This superceeds all previous Errata Sheets.)
DATE: October 11, 1971

Page:	Now Reads:	Change To:
1-4	Table 1-1 Elco Pin Connections Pin 4 = -12VDC	Pin 4 = +12VDC
3-1	Output Level Meter:	ADD An input signal level greater than 75 millivolts RMS, in conjunction with an unterminated output load, may result in the meter "pegging" off scale. This is normal.

INSTRUCTION MANUAL

CRYSTAL OSCILLATOR/LINE DRIVING AMPLIFIER

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DATA-CONTROL SYSTEMS, INC., COMMERCE DRIVE, DANBURY, CONNECTICUT 06810

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MODEL GXA-1

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Figure 1-1. Crystal Oscillator/Line Driving Amplifier, Model GXA-1

SECTION I

GENERAL DESCRIPTION AND LEADING PARTICULARS

1-1. GENERAL.

1-2. This publication contains information necessary for understanding, operating, and maintaining the Model GXA-1, Crystal Oscillator/Line Driving Amplifier, Figure 1-1, designed and manufactured by Data-Control Systems, Inc., Commerce Drive, Danbury, Connecticut 06810.

1-3. This information is presented in the following sections: Section I, General Description and Leading Particu;ars; Section II, Installation; Section III, Operation; Section IV, Theory of Operation; Section V, Maintenance and Troubleshooting; and Section VI, Drawings.

1-4. PURPOSE AND SCOPE.

1-5. The Model GXA-1 incorporates a crystal controlled oscillator, buffer stage and line driving amplifier and is designed to be used in conjunction with FM multiplex tape speed compensation networks. A reference tone generated by the crystal oscillator is available at two outputs; one output is connected (within the DCS Model GMA, Module Assembly) to the input of the self-contained line driving amplifier, which in turn, is resistively summed with the output of a given number of voltage controlled oscillators; the second output may be used to drive as many as fourteen (14) Model GSA-5 summing/line driving amplifiers or other similar DCS summing amplifiers. This crystal reference tone (output 2) is first buffered within each of the externally connected summing/line driving amplifiers and is then resistively mixed with the data composite at each amplifier input.

1-6. A plug-in unit containing the appropriate crystal and its respective filter determines the frequency of the crystal oscillator section of the GXA-1. A change in output frequency of the crystal oscillator is accomplished by removing a side cover and interchanging the plug-in frequency unit.

1-7. The buffer stage within the GXA-1 serves to isolate any externally introduced signal from the data composite and has a gain of approximately -20 dB.

1-8. The summing/line driving section of the GXA-1 is a low distortion, wide band, amplifier which normally accepts as its input a composite signal consisting of a number of data subcarriers plus a single reference carrier and provides an output voltage gain adjustable from 0 to greater than 20 into its rated load. A fixed peak-to-peak subcarrier multiplex output level independent of the number of combined subcarriers is provided in the GXA-1. When used in conjunction with magnetic tape recording, this feature eliminates the necessity for record level adjustment as the number of subcarriers in a multiplex is varied. The front panel meter indicates the output signal level in volts peak-to-peak and is used to monitor both single and multiplexed channel subcarriers. Figure 1-2 shows a typical system utilizing the GXA-1.

1-9. PHYSICAL CHARACTERISTICS.

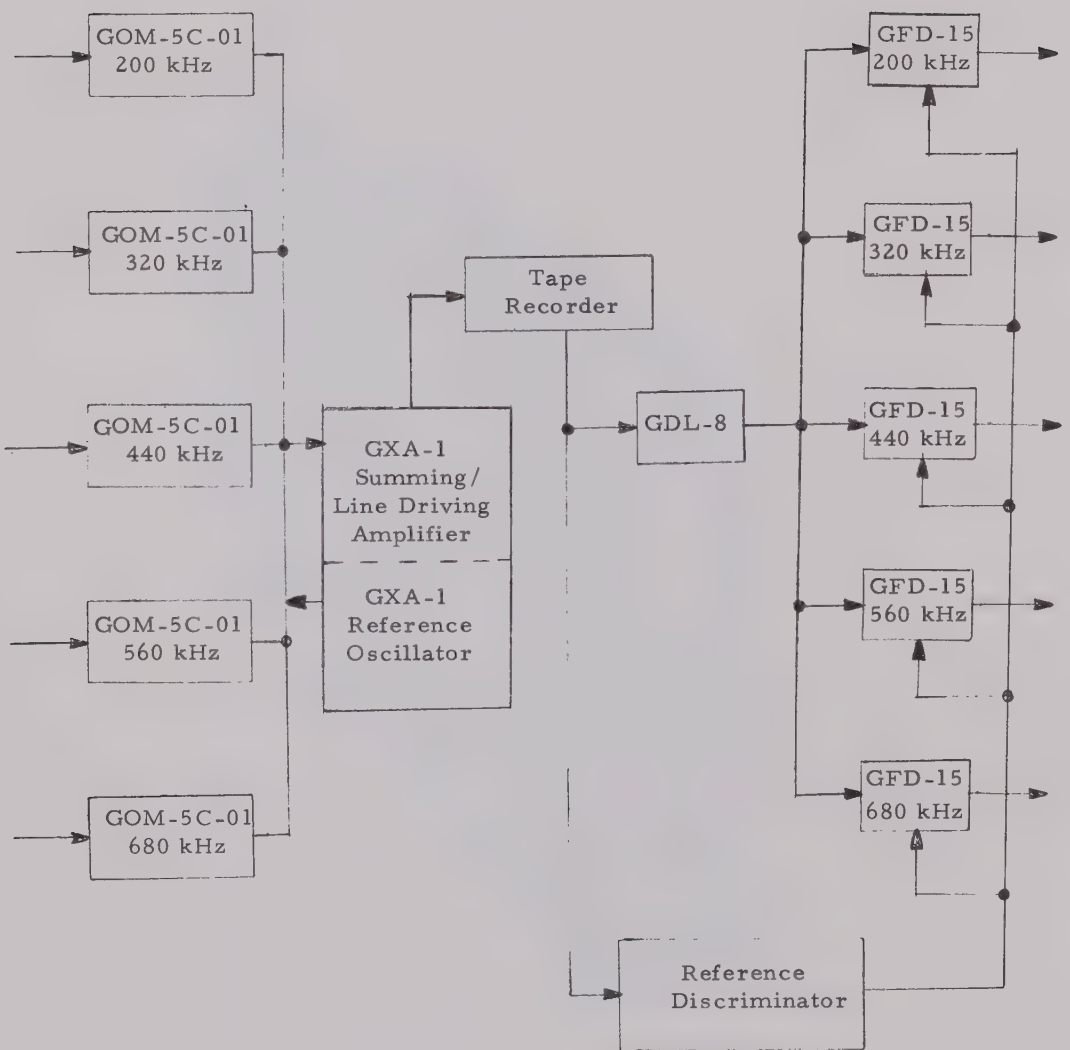


Figure 1-2. Typical Five Channel Constant Bandwidth System using a GXA-1

Dimensions:	1.14" wide x 3.29" high x 10.5" long.
Weight:	18 ounces.
Mounting:	Mounts in a single module space in a GMA Module Assembly and is secured in place by a locking captive screw.
Connectors:	All electrical connections to the GXA-1 are made through Elco-Varicon connectors.
Colors:	The front panel is brushed aluminum with black silkscreen lettering. Side panels are finished with a gold chromated protective film.

1-10. ELECTRICAL CHARACTERISTICS.

Crystal Oscillator Section

Frequency Range:	Frequencies from 17 kHz to 2.0 MHz are available. Standard frequencies are 25, 50, 100, 120, 200, 240, 400, 680, 1000 and 1300 kHz. The accuracy of the Crystal Oscillator is within 0.01% of the frequency specified.
Distortion:	Total harmonic distortion is less than 0.5%.
Stability:	Within ±0.01% of front panel designated frequency from 15°C to 40°C without temperature stabilization of crystals.
High Impedance Output:	For direct summing with a single VCO multiplex. Provides greater than 160 millivolts RMS from a nominal 196 ohm source impedance.
Low Impedance Output:	Used to drive a number of DCS Model GSA-5's, or equivalent, Line Driving Amplifiers. Provides greater than 160 millivolts RMS from a nominal 51 ohm source impedance.

Buffer Amplifier Section

Maximum Input:	10 volts peak-to-peak, internally adjusted.
Input Impedance:	Greater than 5000 ohms.
Output Voltage:	Approximately 20 dB below the level of the input signal. Not to exceed .2 V RMS.
Output Impedance:	Nominally 196 ohms.

Line Driver Amplifier Section

Input Signal Level:	0.15 volts RMS required for rated output at maximum gain adjustment into 51 ohms.
Input Impedance:	Nominally 500 ohms shunted by approximately 120 pf.
Frequency Response:	Flat within ±1 dB from 300 Hz to 2.0 MHz. The response of the amplifier is 4.0 MHz.
Intermodulation Distortion:	For 1.3 and 1.5 MHz signals of equal amplitudes at the maximum input level required to produce 6 volts peak-to-peak into 51 ohms, the 200 kHz difference frequency is down greater than 40 dB.
Output Impedance:	51 ohms nominal. (Other impedances greater than 51 ohms are optionally available.)
Output Level:	Adjustable from a nominal 0 to 6 volts peak-to-peak into a 51 ohm load.

1-11. POWER REQUIREMENTS.

1-12. All the supply voltages are provided by the DCS Model GMA Module Assembly. Specific DC supply voltages required and the respective current drawn from each supply is as follows:

-12 V, 15 milliamps

+12 V, 22 milliamps

+18 V, 6 milliamps

1-13. ENVIRONMENTAL REQUIREMENTS.

1-14. The GXA-1 will operate within specifications under the following environmental conditions:

Operating Temperature:	0° to +50°C.
Reduced Spec Operating Temperature:	-20° to +70°C.
Altitude (Operating and Non-Operating):	-2,000 to +15,000 ft.
Humidity (Operating and Non-Operating):	0 to 95% non-condensing
Cooling:	Forced air ventilation provided by the Model GMA Module Assembly in which the GXA-1 is mounted.

1-15. INTERCONNECTION.

1-16. All connections to the GXA-1 are made in the rear of the Module through an Elco Varicon connector. Elco pin connections and their functions are called out in Table 1-1.

Table 1-1. Elco Pin Connections

Pin Number	Designation
1	No Connection
2	No Connection
3	No Connection
4	-12 V DC
5	Ground
6	Line Driver Amplifier Input
7	-12 V DC

Table 1-1. Elco Pin Connections (continued)

Pin Number	Designation
8	No Connection
9	+18 V DC Unregulated
10	No Connection
11	Buffer Amplifier Output
12	Ground
13	Buffer Amplifier Input
14	Ground
15	Crystal Oscillator High Impedance Output
16	No Connection
17	Crystal Oscillator Low Impedance Output
18	Ground
19	Line Driver Amplifier Output
20	Ground

SECTION II

INSTALLATION

2-1. GENERAL.

2-2. This section covers the initial procedures required to prepare the GXA-1 for operation. The scope of this information precludes actual operation of the equipment.

2-3. UNPACKING AND HANDLING.

2-4. The unit is sealed in a moisture proof polyethelene blister pack assembly and insulated from shock during shipment with polyurethane foam packing material.

2-5. Remove the corrugated carton and packing material and perform a general visual inspection. Retain carton and covering until inspection is completed.

2-6. If the visual inspection discloses physical damage immediately notify the carrier. If during subsequent testing the equipment does not meet operating specifications notify:

Field Service Department
Data-Control Systems, Inc.
Commerce Drive
Danbury, Connecticut 06810

2-7. MOUNTING.

2-8. The Crystal Oscillator/Line Driving Amplifier is designed to be mounted in a DCS type GMA Module Housing which contains the power supply and the proper wiring for interconnection. To install the GXA-1 proceed as follows:

a. Note the proper designation on the bottom edge of the GMA Module Housing. Insert the GXA-1 into the designated single module space and apply pressure until connectors engage.

b. Rotate the captive screw until unit is completely installed.

2-9. COOLING.

2-10. Each GMA Module Housing is equipped with a muffin fan which pressurizes the Housing to 0.2 inches of water and forces cooling air over the GXA-1 stabilizing its operating temperature.

2-11. LUBRICATION. If the GMA Module Assembly is used in temperatures exceeding 110°F, or in areas of severe vibration, the muffin fan should be lubricated at least once a year to ensure reliable performance.

NOTE

A hypodermic type oil injector must be used to lubricate the fan. To inject the oil, pierce the label and concealed self-sealing rubber cap located under the label.

SECTION III

OPERATION

3-1. GENERAL.

3-2. This section describes the operating procedures for the GXA-1.

3-3. CONTROLS AND INDICATORS.

3-4. Table 3-1 lists the front panel controls and indicators.

Table 3-1. Controls and Indicators

Control/Indicator	Location	Function
Output Level Control	Front Panel	Adjusts gain of the Line Driving Amplifier.
Output Level Meter	Front Panel	Indicates Output level of the Line Driving Amplifier in volts peak-to-peak.
MPLX IN Monitor Jack	Front Panel	Monitors Output signal of the Line Driving Amplifier.
XTAL OUT Monitor Jack	Front Panel	Monitors Output signal of the Crystal Oscillator.
GRD Monitor Jack	Front Panel	GXA-1 System ground.

3-5. OPERATING PROCEDURE.

3-6. It is assumed that the unit has been installed in the GMA Housing as described in Section II. Refer to Figure 3-1 for a front panel view. To operate the GXA-1 proceed as follows:

a. Set the associated GMA power switch to the ON position.

b. Allow a 15 minute warmup period.

c. With the rack blower assembly switch in the OFF position, check the air flow at the GMA panel openings to be sure the muffin fan is operating. When modules are missing from the GMA, use a blank panel, GBP-1 or GBP-2, to maintain cooling air pressure.

d. Adjust the Output Level Control on the Line Driving Amplifier full clockwise and apply a 100 kHz, 300 MVPP signal to the input (Elco pin 6) of the amplifier.

e. Monitor the output of the Line Driving Amplifier (Elco pin 9) for an approximately 6 V PP signal and while varying the Output Level Control observe the output amplitude changing.

f. Apply a 100 kHz 10 V PP max. signal to the input of the Buffer (Elco pin 13) and monitor the output (Elco pin 11) for a signal of approximately .2 V PP. Refer to paragraph 1-10, Buffer Amplifier Section).

g. Monitor the XTAL jack (output of the crystal oscillator) for a signal

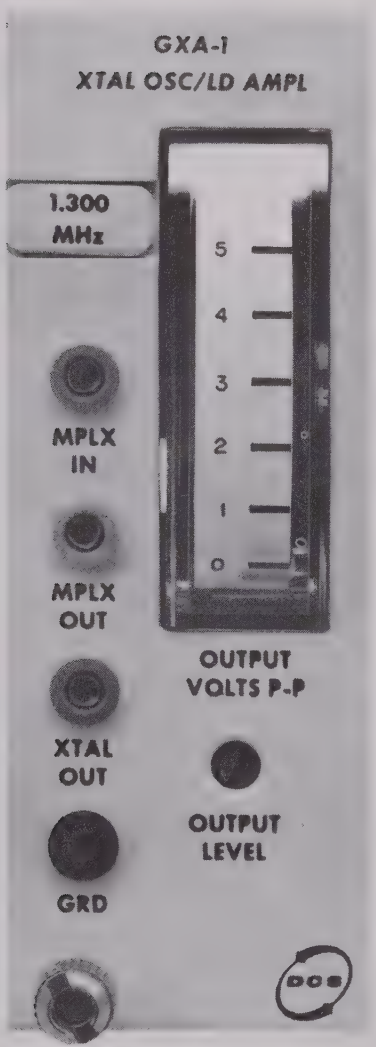


Figure 3-1. Controls and Indicators, Model GXA-1

equal to the frequency as designated on the front panel.

h. In order to turn the GXA-1 off, it is necessary to throw the GMA power switch to the off position or loosen the captive screw and disengage the module from the GMA masterboard by pulling the unit out a few inches.

SECTION IV

THEORY OF OPERATION

4-1. GENERAL.

4-2. This section describes the Theory of Operation of the GXA-1 with reference to the Functional Block Diagram of Figure 4-1 and Schematic Drawing 019184.

4-3. THEORY OF OPERATION.

4-4. The GXA-1 consists of the following three circuits: a line driving amplifier with a meter across the output for peak-to-peak output readings, a crystal oscillator, and a buffer amplifier stage.

4-5. SUMMING/LINE DRIVING AMPLIFIER Basically, the Summing/Line Driving Amplifier is an operational amplifier with power output capability. IC1 (integrated circuit) is a Darlington input stage, differential type amplifier. Q1 is a conventional common emitter amplifier, and Q2 and Q3 are emitter-follower drivers.

4-6. Transistors Q4 and Q5 make up the class "B" power output stage. Resistors R16 and R13 act as voltage limiters for the output transistors, and R14 and R15 provide thermal run-away protection.

4-7. The metering circuit which measures the peak-to-peak output voltage applied to Elco pin 19 consists of Q6, CR1 and M1. It is connected between the output and ground. Potentiometer R23 adjusts the meter circuit for zero with no signal applied.

4-8. Both the input and output of the Summing/Line Driving Amplifier are AC coupled. The overall gain is approximately 46 dB into 51 ohms.

4-9. CRYSTAL OSCILLATOR. Fundamentally, the Crystal Oscillator is an integrated differential amplifier (IC2) with a series mode crystal feedback. A plug-in printed circuit board containing a crystal and its filter determines the output frequency of the oscillator.

4-10. The output of the crystal plug-in board feeds emitter-follower Q8 which buffers the signal from the output stages. Q9 is the driver amplifier for the summing output (Elco Pin 15). This output is used to drive the self-contained summing/line driving amplifier in the GXA-1 (Elco Pin 15 is wired to Elco Pin 6 within the GMA Module Assembly). Transistor Q10 is a 50 ohm output buffer amplifier used to drive other signal equipment or summing amplifiers. R48 adjusts the output level of this stage. Maximum output shall be no more than .2 V RMS.

4-11. BUFFER AMPLIFIER. Q7 is a Buffer Amplifier that accepts time code or other high level signals which are desirable to sum in a FM multiplex. Output impedance is 196 ohms and overall gain is equal to -20 dB. R37 adjusts the sensitivity of this amplifier. Maximum output shall be no more than .2 V RMS.

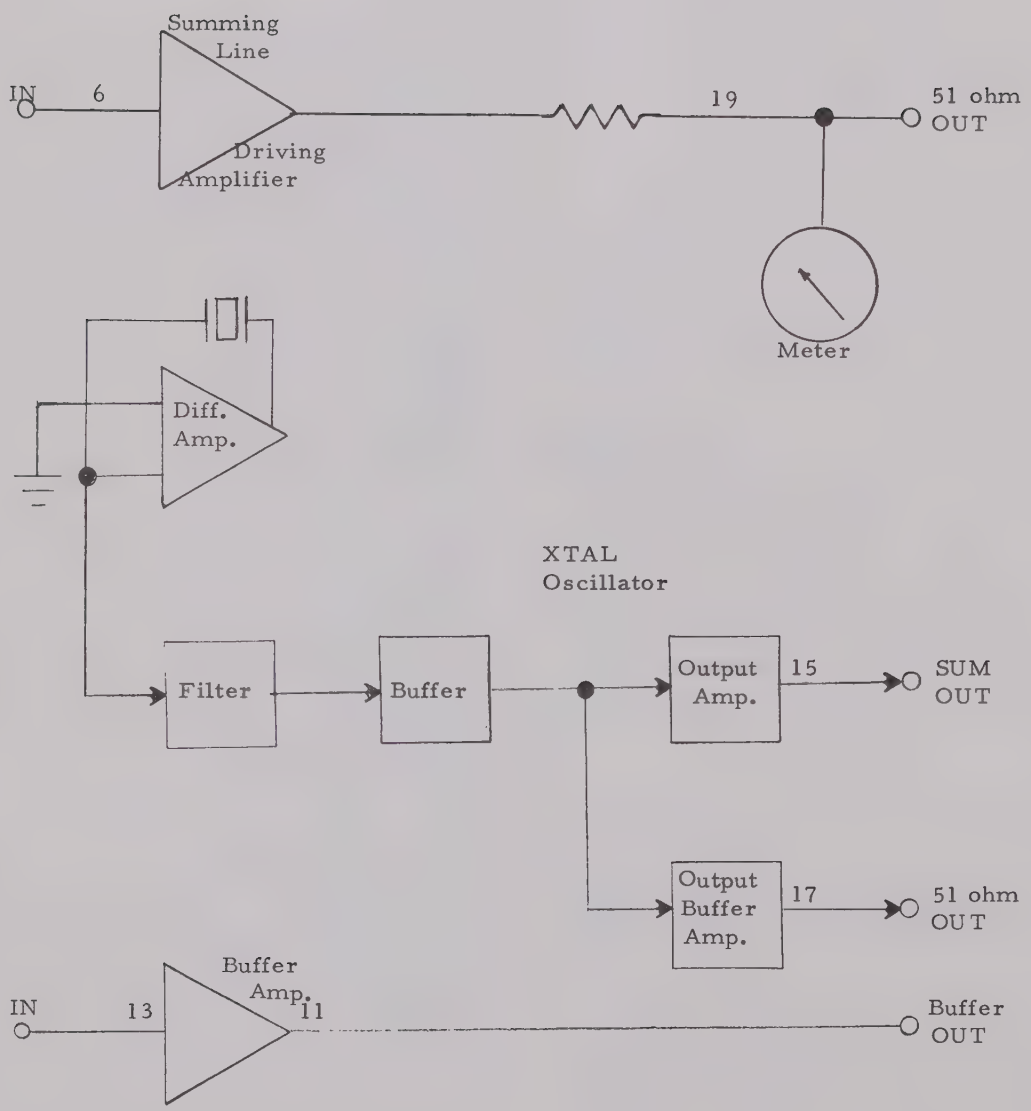


Figure 4-1. Block Diagram, GXA-1

SECTION V

MAINTENANCE

5-1. GENERAL.

5-2. This section covers general maintenance and troubleshooting of the GXA-1. The location of major components are referenced in assembly drawings 019193 and 019194 and in Figure 5-1.

5-3. TEST EQUIPMENT.

5-4. Test equipment is listed in Table 5-1.

Table 5-1. List of Test Equipment

Nomenclature	Characteristics
Oscillator	HP651A or equivalent
Volt Meter	HP400CD or equivalent
Resistance Decade Box	Eico 1171 or equivalent
Oscilloscope	Tektronix 535 or equivalent
Volt Ohmmeter	Simpson 260 or equivalent
Frequency Counter	TSI/R or equivalent
Test Fixture	DCS GTF-2

5-5. PREVENTIVE MAINTENANCE.

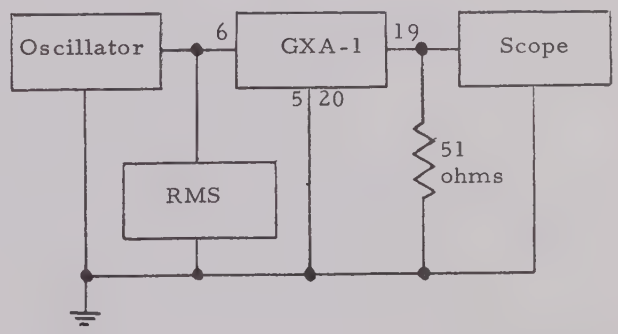
5-6. VISUAL INSPECTION. Remove cover and inspect all elements for physical signs of damage such as broken or leaking components, burned or charred spots on resistors or capacitors, loose or oxidized soldered wires, and apread or bent Elco pins.

5-7. CLEANING. Since cooling air is constantly flowing through the equipment, the main blower rack should be properly filtered. The rack should be cleaned periodically with a standard vacuum cleaner. Panel and covers may be cleaned with a suitable solvent such as carbon met. Interior parts must be air blown.

5-8. MINIMUM PERFORMANCE TESTS.

5-9. The minimum performance test required to ensure proper operation of the equipment is described in this section. If performance falls below operating specifications, the cause must be determined through troubleshooting procedures.

5-10. LINE DRIVING AMPLIFIER INPUT LEVEL. Set up the equipment as shown below and proceed as follows: (Insert the GTF-2 into the GMA Housing and plug the GXA-1 into the GTF-2).



a. Turn power on and allow a 15 minute stabilization period.

b. Set the oscillator to any frequency between 100 Hz and 4 MHz with amplitude of 0.1 volts RMS.

c. Set the OUTPUT LEVEL adjust fully clockwise.

d. Increase input level until waveform on scope becomes distorted.

e. Input level on RMS meter should be

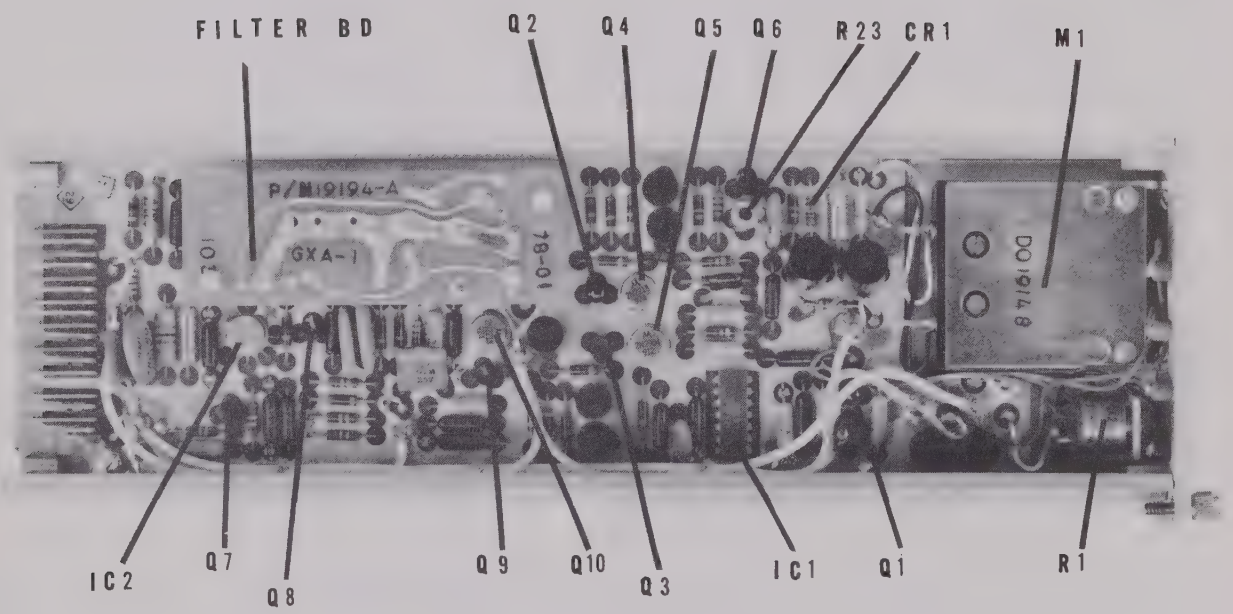
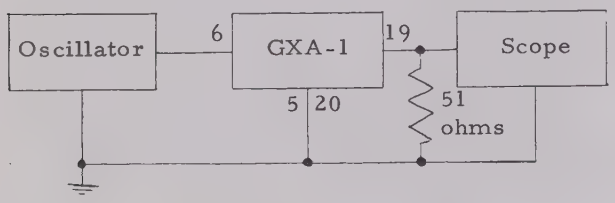


Figure 5-1. GXA-1 with Major Components called out

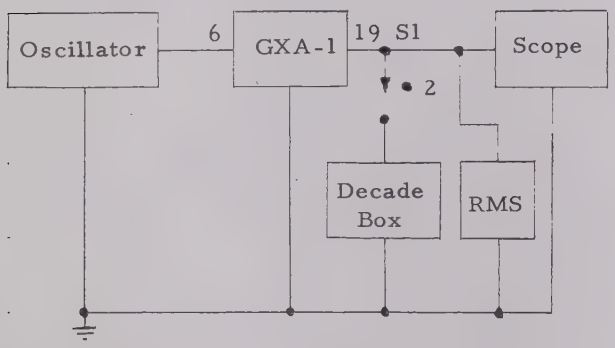
greater than 110 mv RMS which corresponds to approximately 300 mv peak-to-peak.

5-11. LINE DRIVING AMPLIFIER OUTPUT LEVEL. Connect the equipment as shown below and proceed as follows:



a. Set the oscillator to any frequency between 300 Hz and 2 MHz.
b. Set the OUTPUT LEVEL adjust on the GXA-1 fully clockwise.
c. Increase the input amplitude until the waveform becomes distorted.
d. The waveform shall be greater than 6 V peak-to-peak.

5-12. LINE DRIVING AMPLIFIER OUTPUT IMPEDANCE. Connect the equipment as shown below and proceed as follows:

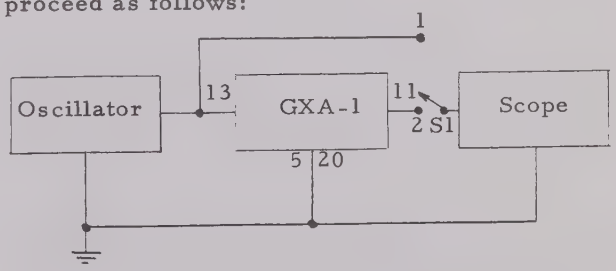


a. Set the oscillator to 1 kHz at a level of 0.1 V RMS.
b. With S1 in the #2 position, record the voltage indicated on the RMS meter.
c. With S1 in the #1 position, select a resistance that will give $\frac{1}{2}$ the reading in step b.
d. The output impedance can now be read directly from the decade box and should be a nominal value of 51 ohms.

5-13. LINE DRIVING AMPLIFIER FREQUENCY RESPONSE. Connect the equipment as shown in paragraph 5-11 and proceed as follows:

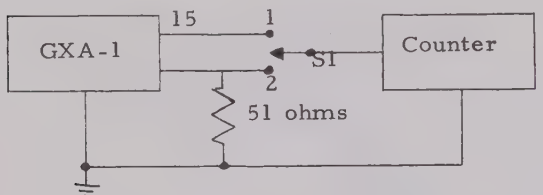
a. While maintaining a constant input level of 0.1 V RMS, vary the oscillator from 300 Hz to 2 MHz.
b. The amplitude variation will remain within ±1 dB range.
c. At 100 Hz and 4 MHz the amplitude response will be down no greater than -3 dB.

5-14. BUFFER AMPLIFIER OUTPUT LEVEL. Connect the equipment as shown below and proceed as follows:



a. Set the oscillator to any frequency between 100 Hz and 1 MHz.
b. With S1 in the #2 position, adjust the oscillator for an output level of .2 V RMS.
c. With S1 in the #1 position, the waveform shall be equal to approximately 2 V RMS.

5-15. CRYSTAL OSCILLATOR OUTPUT. Connect the equipment as shown below and proceed as follows:



a. With S1 in the #1 position, observe a reading on the frequency counter equal to the frequency designated on the front panel.

b. Set S1 to position #2 and observe a reading on the counter equal to the frequency designated on the front panel.

5-16. TROUBLESHOOTING.

5-17. Troubleshooting the GXA-1 Module consists of injecting a signal into the input of the GXA-1 and tracing this signal through its stages.

5-18. Remove the defective GXA-1 from the GMA Housing and remove the cover from the GXA-1. Insert the GTF-2 test fixture into the GMA Housing and plug the GXA-1 into the GTF-2.

5-19. LINE DRIVING AMPLIFIER. Apply a 1 kHz, 0.1 V RMS signal to Elco Pin 6 of the GXA-1. With the scope monitor terminal E16 (see drawings 019184 and 019193) and check for a signal at this point.

5-20. If no signal is present at terminal E16, adjust potentiometer R1 clockwise. If the applied input signal does not appear, check R1, C1 and C2 with an ohmmeter.

5-21. With the input signal present at terminal E16, monitor pin 4 of IC1 and check for a 1 kHz, 0.5 V RMS (approximate) signal. If no signal is present at pin 4, check IC1.

5-22. With the proper signal at pin 4 of IC1, monitor terminal E14 for a 1 kHz, 2.5 V RMS (approximate) signal. If no signal is present at terminal E14, check Q1 through Q5.

5-23. The meter circuit consists of one active component, Q6 and CR1. If the meter does not function properly, check these two components with an ohmmeter.

CAUTION

Do not check across the meter movement (terminals E12 and E13) with an ohmmeter as the internal battery may destroy the meter movement.

5-24. BUFFER STAGE. Apply a 1 kHz signal to input Elco Pin 13 of the GXA-1 and check for a .2 V RMS (-20 dB) signal on Pin 11. If no signal is present on pin 11, check Q7.

5-25. CRYSTAL OSCILLATOR. Check the base of Q8 for a signal equal to the frequency designated on the front panel. If this signal is not present, check IC2 and the crystal located on the filter board.

5-26. With the correct signal at the emitter of Q8, monitor terminals E3 and E5 for a signal equal to the frequency designated on the front panel. If no signal is present at terminals E3 and E5, check Q9 and Q10.

5-27. After the defective GXA-1 has been repaired, perform the minimum performance tests as previously described.

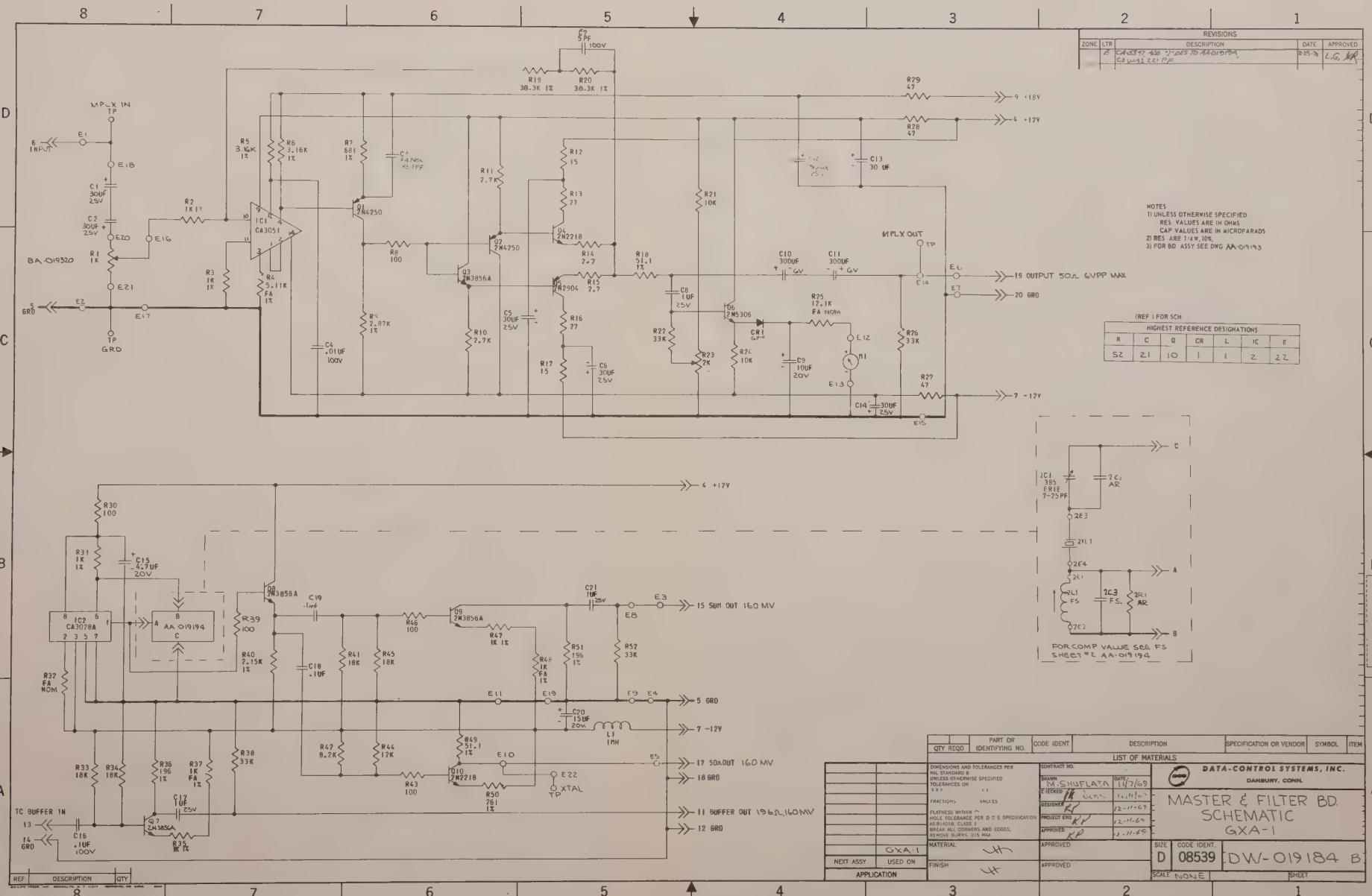
SECTION VI

DRAWINGS

6-1. GENERAL.

6-2. The drawings listed in this section are furnished to supplement the information given in the text.

DW-019184	Schematic, GXA-1
AA-019193	Master Board Assembly, GXA-1
AA-019194	Filter Board Assembly, GXA-1
CO-019324	Outline Drawing, GXA-1
CA-019198	Final Assembly, GXA-1



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	CA3047 ADD "J" DES TO AA019194, C8 WAS 221 PF	8-25-69	L.G.

REF	DESCRIPTION	QTY

QTY REQD	PART OR IDENTIFYING NO.	CODE IDENT	DESCRIPTION	SPECIFICATION OR VENDOR	SYMBOL	ITEM

LIST OF MATERIALS

DIMENSIONS AND TOLERANCES PER MIL STANDARD 8
UNLESS OTHERWISE SPECIFIED TOLERANCES ON
X ±.X
FRACTIONS ANGLES
FLATNESS WITHIN ~
HOLE TOLERANCE PER D O S SPECIFICATION AS 8140/8, CLASS 1
BREAK ALL CORNERS AND EDGES, REMOVE BURRS .015 MAX

CONTRACT NO.
DRAWN M. SHUFLATA 11/7/69
CHECKED
DESIGNER
PROJECT ENG
APPROVED
MATERIAL
FINISH
APPROVED
APPROVED

DATA-CONTROL SYSTEMS, INC.
DANBURY, CONN.

MASTER & FILTER BD. SCHEMATIC GXA-1

NEXT ASSY	USED ON
	GXA-1

APPLICATION

SIZE D | CODE IDENT. 08539 | DW-019184 B

SCALE NONE | SHEET

APPLICATION	
NEXT ASSY	USED ON
CA-019188	GXA-1

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
B	CA-5397, C3 WAS 221 PF	2-25-70	L.G.

REV																									
SHEET																									
REV																									
SHEET																									
REV. STATUS OF SHEETS	REV	B	A	B	A	A	B	A																	
	SHEET	1	2	3	4	5	6	7																	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONS ±
DECIMALS ±
ANGLES ±

MATERIAL:

DRAWN MGS 11/13/69
CHECKED
PROJ ENG
APPROVED
APPROVED
APPROVED
APPROVED
DATE

DATA-CONTROL SYSTEMS, INC.
DANBURY, CONN.

BOARD ASSY. MASTER

SIZE	CODE IDENT NO		
A	08539	A-019193	B

SCALE

SHEET 1 OF 7

ITEM	SYMBOL	PART NO.	DESCRIPTION		QTY REQ'D	REV.
1		DF-019183	BOARD FAB MASTER		REF	
2		DW-019184	SCHEMATIC MASTER BD.		REF	
3		10068	PAD TRANSISTOR MILTON ROSS		3	
	R1		ON BRACKET, POT ASSY.			
	R2		RES. ELECTRA MF52C-D 1/4W 1%	1K	1	
	R3			1K	1	
	R4	F.A.		5.11K	1	
	R5			3.16K	1	
	R6			3.16K	1	
	R7		ELECTRA MF52C-D 1/4W 1%	681Ω	1	
	R8		AB CB 1/4W 10%	100Ω	1	
	R9		ELECTRA MF52C-D 1/4W 1%	2.87K	1	
	R10		AB CB 1/4W 10%	2.7K	1	
	R11			2.7K	1	
	R12			15Ω	1	
	R13			27Ω	1	
	R14			2.7Ω	1	
	R15			2.7Ω	1	
	R16			27Ω	1	
	R17		AB CB 1/4W 10%	15Ω	1	
	R18		ELECTRA MF52C-D 1/4W 1%	51.1Ω	1	
	R19			38.3K	1	
	R20		ELECTRA MF52C-D 1/4W 1%	38.3K	1	
	R21		AB CB 1/4W 10%	10K	1	
	R22		AB CB 1/4W 10%	33K	1	
	R23		POT HELITRIM 62 PR	2K	1	
	R24		AB CB 1/4W 10%	10K	1	
	R25	F.A.	ELECTRA MF52C-D 1/4W 1%	12.1K	1	
	R26		AB CB 1/4W 10%	33K	1	
	R27			47Ω	1	
	R28			47Ω	1	
	R29			47Ω	1	
	R30		AB CB 1/4W 10%	100Ω	1	
	R31		ELECTRA MF52C-D 1/4W 1%	1K	1	
	R32		F.A. NOM OPEN		1	
	R33		AB CB 1/4W 10%	18K	1	
	R34		AB CB 1/4W 10%	18K	1	
	R35		ELECTRA MF52C-D 1/4W 1%	1K	1	
	R36			196Ω	1	
	R37		ELECTRA MF52C-D 1/4W 1%	1K	1	
	R38		AB CB 1/4W 10%	33K	1	
	R39		AB CB 1/4W 10%	100Ω	1	
	R40		ELECTRA MF52C-D 1/4W 1%	215K	1	
	R41		RES. AB CB 1/4W 10%	18K	1	

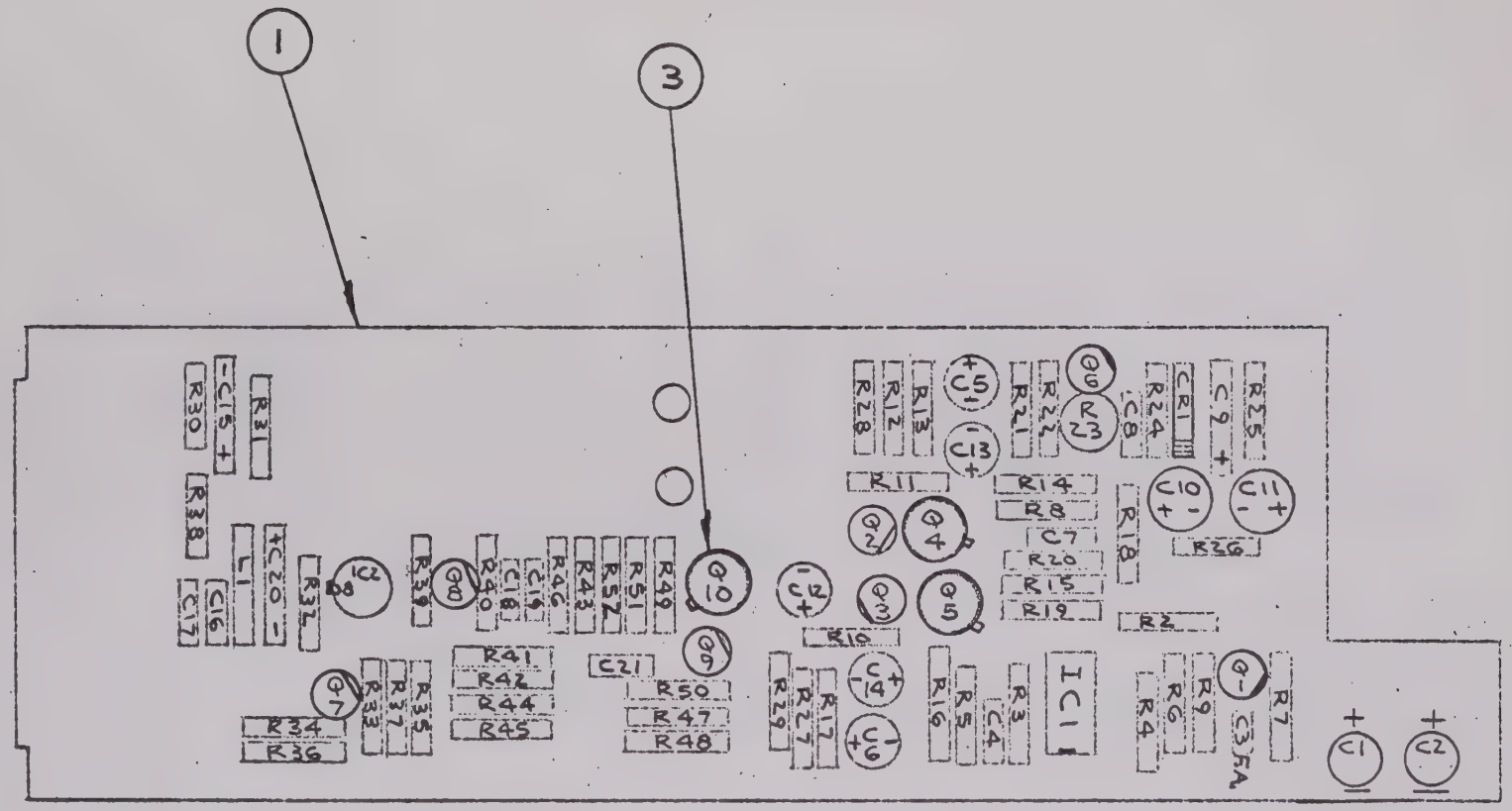
SIZE	CODE IDENT. NO.		
A	08539	A-019193	A
		SHEET 2	

ITEM	SYMBOL	PART NO.	DESCRIPTION	QTY REQ'D	REV.
	R42		RES ABCB 1/4W 10% 8.2K	1	
	R43		100Ω	1	
	R44		12K	1	
	R45		18K	1	
	R46		ABCB 1/4W 10% 100Ω	1	
	R47		ELECTRA MF52C-D 1/4W 1% 1K	1	
	R48	F.A.	1K	1	
	R49		51.1Ω	1	
	R50		261Ω	1	
	R51		ELECTRA MF52C-D 1/4W 1% 196Ω	1	
	R52		RES. ABCB 1/4W 10% 33K	1	
	C1	DD-015890-03	CAP GENTRONICS 101D 25V 30μf	1	
	C2	DD-015890-03	GENTRONICS 101D 25V 30μf	1	
	C3		DURMICA 100V 1% FA NOM 357pF	1	
	C4		RMC DISCAP 100V +80-20 .01μf	1	
	C5	DD-015890-03	GENTRONICS 101D 25V 30μf	1	
	C6	DD-015890-03	GENTRONICS 101D 25V 30μf	1	
	C7		DURMICA 100V 1% 5pf	1	
	C8		SPRAGUE MONO 5C13 25V 1μf	1	
	C9		SPRAGUE 150D ±20% 20V 10μf	1	
	C10		GENTRONICS 101D 6V 300μf	1	
	C11		GENTRONICS 101D 6V 300μf	1	
	C12	DD-015890-03	GENTRONICS 101D 25V 30μf	1	
	C13	DD-015890-03	GENTRONICS 101D 25V 30μf	1	
	C14	DD-015890-03	GENTRONICS 101D 25V 30μf	1	
	C15		SPRAGUE 150D ±20% 20V 4.7μf	1	
	C16		RMC DISCAP TA 100V +80-20 .1μf	1	
	C17		SPRAGUE MONO 5C13 25V 1μf	1	
	C18		RMC DISCAP TA 100V +80-20 .1μf	1	
	C19		RMC DISCAP TA 100V +80-20 .1μf	1	
	C20		SPRAGUE 150D ±20% 20V 15μf	1	
	C21		CAP SPRAGUE MONO 5C13 25V 1μf	1	
	CR1		DIODE I.T.T. GB15	1	
	Q1		TRANS FAIRCHILD 2N4250	1	
	Q2		TRANS FAIRCHILD 2N4250	1	
	Q3		TRANS G.E. 2N3856A	1	

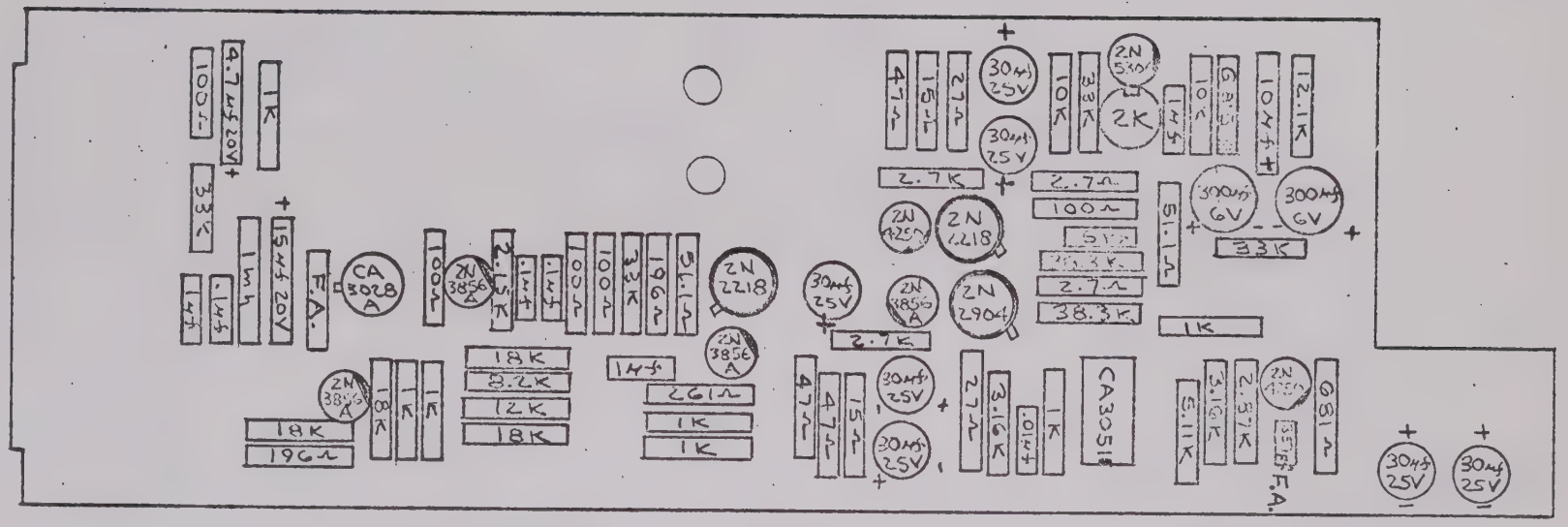
SIZE	CODE IDENT. NO.		
A	08539	A-019193	B
		SHEET 3	

ITEM	SYMBOL	PART NO.	DESCRIPTION	QTY REQ'D	REV.
	Q4		TRANS MOTOROLA 2N2218	1	
	Q5		MOTOROLA 2N2904	1	
	Q6		G.E. 2N5306	1	
	Q7		G.E. 2N3856A	1	
	Q8		G.E. 2N3856A	1	
	Q9		G.E. 2N3856A	1	
	Q10		TRANS MOTOROLA 2N2218	1	
	IC1		I.C. RCA CA3051	1	
	IC2		I.C. RCA CA3028A	1	
	L1		INDUCTOR DELEVAN 2500 1mh	1	

SIZE	CODE IDENT. NO.		
A	08539	A-019193	A
		SHEET 4	



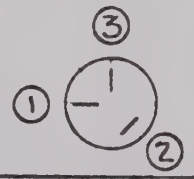
CODE IDENT. NO.	SIZE		REV.
08539	A	A-019193	A
SCALE		SHEET 5	



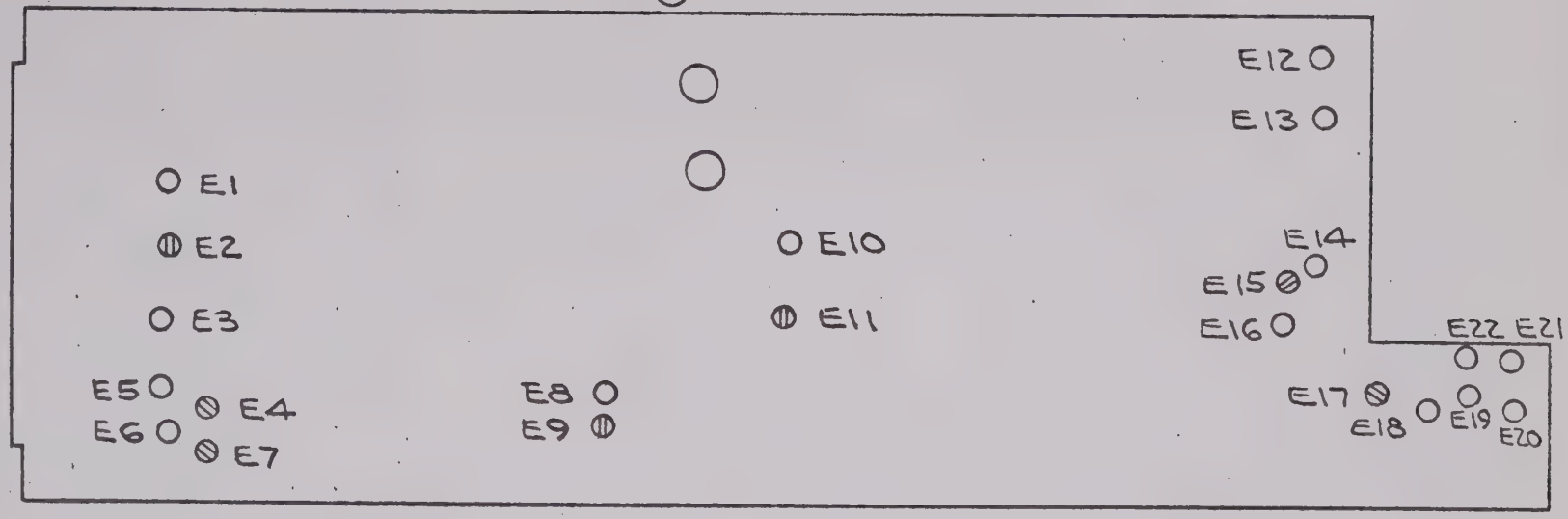
CODE IDENT. NO.	SIZE		REV.
08539	A	A-019193	B
SCALE		SHEET 6	

FROM	TO
E12	METER
E13 GRD	METER
E16	R1 WIPER ②
E21	① GRD
E20	③
① GRD	BLACK TP
E22	RED TP
E14	BLUE TP
E18	GREEN TP

COAX R196U				
CENTER	SHIELD	TO	CENTER	SHIELD
E1	E2	TO	E18	E17
E3	E4	TO	E8	E9
E5	E4	TO	E10	E11
E6	E7	TO	E14	E15
E10	E11	TO	E22	E19



R1 - AB POT
REAR VIEW (BA-019320)



CODE IDENT. NO.	SIZE		REV.
08539	A	A-019193	A
SCALE		SHEET 7	

APPLICATION		REVISIONS			
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED
CA-019188	GXA-1	B	CA-5347, ADD. NOTE 2, C3 WAS 2450PF	2-25-70	L.G. HK

NOTE:
1- SEE INDEX SHEET 2 FOR F.S. SHEETS.
2- ALL COMP. DESIGNATIONS ARE PREFIXED BY 2.

REV																							
SHEET																							
REV																							
SHEET																							
REV. STATUS OF SHEETS	REV	B	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A	B	A	A		
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONS ±
DECIMALS ±
ANGLES ±

MATERIAL:

DRAWN MGS 11/14/69
CHECKED
PROJ ENG
APPROVED
APPROVED
APPROVED
APPROVED
DATE

DATA-CONTROL SYSTEMS, INC.
DANBURY, CONN.

FILTER BD. ASSY.

SIZE	CODE IDENT NO		
A	08539	A-019194	B

SCALE

SHEET 1 OF 20

INDEX SHEET

REV.

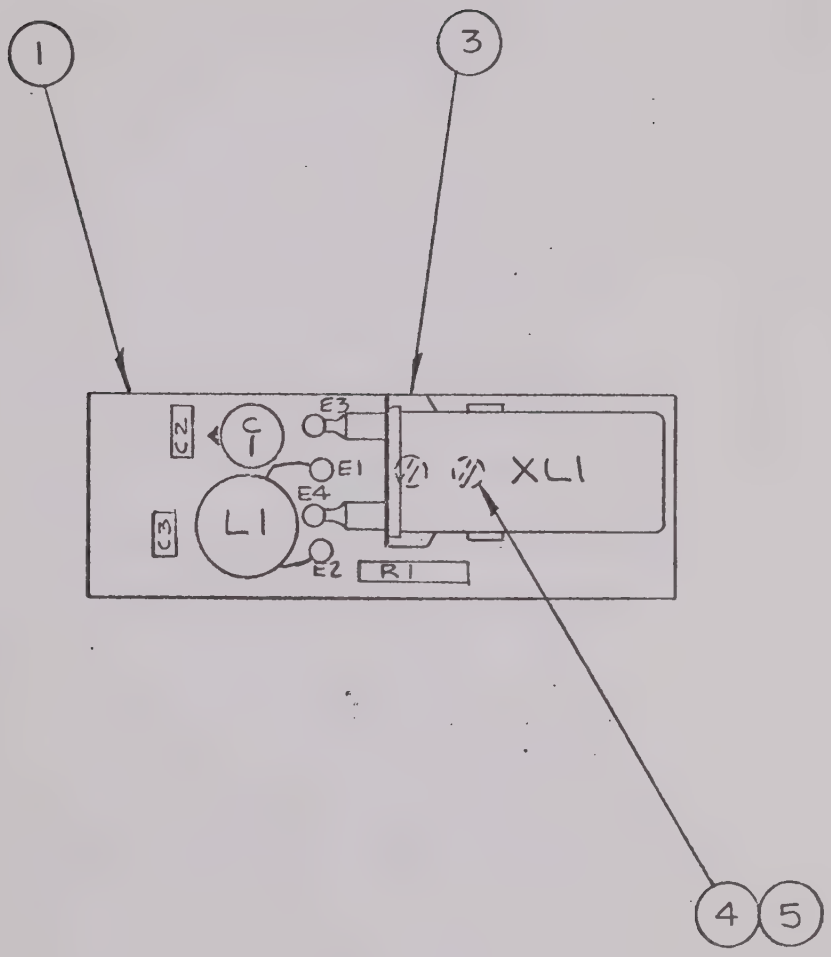
FREQ	SHEET	
25 KHz	6	AA-019194-01
50 KHz	7	-02
100 KHz	8	-03
120 KHz	9	-04
200 KHz	10	-05
240 KHz	11	-06
250 KHz	12	-07
400 KHz	13	-08
500 KHz	14	-09
680 KHz	15	-10
800 KHz	16	-11
1 MHz	17	-12
1.3 MHz	18	-13
1.536 MHz	19	-14
1.9 MHz	20	AA-019194 -15

ITEM	SYMBOL	PART NO.	DESCRIPTION	QTY REQ'D

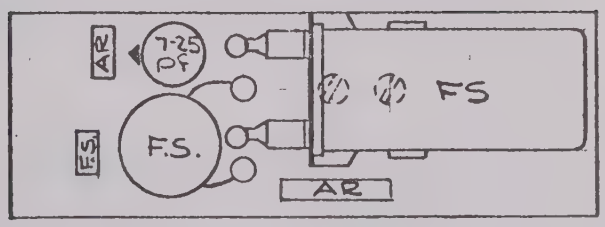
SIZE	CODE IDENT. NO.		
A	08539	A-019194	A
		SHEET 2	

ITEM	SYMBOL	PART NO.	DESCRIPTION	QTY REQ'D	REV.			
1		CF-019192	BOARD FAB.	REF				
2		DW-019184-	SCHEMATIC	REF				
3			AUGUAT SOCKET 8000-AG3	1				
4		AS-826028-26	SCREW 2-56NC-2A PHMS	2				
5		AS-826020-26	NUT SELF LOCKING	2				
			RESISTORS					
	R1		A.R.	1				
			CAPACITORS					
	C1		ERIE 538-002-93B 7-25pf.	1				
	C2		AR.	1				
	C3		DURMICA DM 100V 1% F.S.	1				
			INDUCTORS					
	L1		F.S.	1				
	XL1	CY-010227	CRYSTAL LAYOUT F.S.	1				

SIZE	CODE IDENT. NO.		
A	08539	A - 019194 -	A
		SHEET 3	



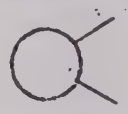
CODE IDENT. NO	SIZE		REV.
08539	A	A-019194	A
SCALE		SHEET 1	



NOTE:
SEE TABULATED SHEETS FOR VALUES.

CODE IDENT. NO	SIZE		REV.
08539	A	A-019194	A
SCALE		SHEET 5	

R1	A.R.
C1	CAP ERIE 538-002-93B 7-25pf
C2	A.R.
C3	DURMICA 100V 1% 6190pf
XL1	BD-010227-01 25KHZ

L1	Potcore 14MM	B65541-K0100-A025
	Bobbin	B65542-A0000-M001
6.55 mh	Flange	B65549-J0001-X000
	Mtg. Brkt.	C140S-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	#34
	Turns	247

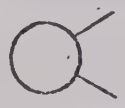
CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-01	A
SCALE	25KHZ	SHEET 6	

R1	A. R.
C1	CAP ERIE 538-002-93B 7-25pf
C2	A. R.
C3	DURMICA 100V 1% 3160 pf
XU1	BD-010227-03 50 KHz

L1	Potcore 14MM	B65541-K0100-A025
3.21mh	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	4/44 LITZ
	Turns	173

CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-02	A
SCALE	50KHZ	SHEET 7	

R 1	A. R.
C 1	CAP ERIE 538-002-938 7-25pf
C 2	A. R.
C 3	DURMICA 100V 1% 3160 pf
XL1	BD-010227-02 100KHz

L1 .801mh	Potcore 14MM	B65541-K0100-A025
	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	10/44 LITZ
	Turns	86

CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-03	A
SCALE	100KHZ	SH 8	

R1	A. R.
C1	CAP ERIE 538-002-93B 7-25pf
C2	A. R.
C3	DURMICA 100V 1% 2670pf
XL1	BD-010227-14 120KHz

L1 .658mh	Potcore 14MM	B65541-K0100-A025
	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	CI408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	10/44 LITZ
	Turns	78

CODE IDENT. NO.	SIZE		REV.
08539	A	A-019194-04	A
SCALE	120KHZ	SHEET 9	

R 1	A. R.
C 1	CAP ERIE 538-002-93B 7-25pf
C 2	A. R.
C 3	DURMICA 100V. 1% 1540pf
XU1	BD-010227-11 200KHz

J1 411mh	Potcore 14MM	B65541-K0100-A025
	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	19/44 LITZ
	Turns	62

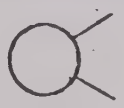
CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-05	A
SCALE	200KHZ	SHEET 10	

R1	A. R.
C1	CAP ERIE 538-002-93B 7-25pf
C2	A. R.
C3	DURMICA 100V 1% 1300 pf
XL1	BD-010227-20 240KHz

L1		
.338 mh	Potcore 14MM	B65541-K0100-A025
	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	19/44 LITZ
	Turns	56

CODE IDENT. NO	SIZE		REV.
09539	A	A-019194-06	A
SCALE	240 KHZ	SHEET 11	

R1	A. R.
C1	CAP ERIE 538-002-93B 7-25pf
C2	A. R.
C3	DURMICA 100V 1% 1240pf
XL1	BD-010227-13 250KHz

L1	Potcore 14MM	B65541-K0100-A025
.327mh	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	19/44 LITZ
	Turns	55

CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-07	A
SCALE	250KHZ	SHEET 12	

R1	A. R.
C1	CAP ERIE 538-002-938 7-25pf
C2	A. R.
C3	DURMICA 100V 1% 768Pf
XL1	BD-0102Z7-15 400 KHz

L1		
.206 mh	Potcore 14MM	B65541-K0100-A025
	Bobbin	B65542-A0000-M001
	Flange	B63549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	22/44 LITZ
	Turns	44

CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-08	A
SCALE	400 KHZ	SHEET 13	

R1	A. R.
C1	CAP ERIE 538-002-93B 7-25pf
C2	A. R.
C3	DURMICA 100V 1% 619 Pf
XL1	BD-010227-51 500 KHz

L1 .164 mh	Potcore 14MM	B65541-K0100-A025
	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	22/44 LITZ
	Turns	39

CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-09	A
SCALE	500 KHZ	SHEET 14	

R1	A. R.
C1	CAP ERIE 538-002-93B 7-25pf
C2	A. R.
C3	DURMICA 100V 1% 487pf
XL1	BD-010227-47 680KHz

L1	Potcore 14MM	B65541-K0100-A025
.112mh	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	30/44 LITZ
	Turns	32

CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-10	A
SCALE	680 KHZ	SHEET 15	

R1	A. R.
C1	CAP ERIE 538-002-93B 7-25pf
C2	A. R.
C3	DURMICA 100V 1% 392 pf
XL1	BD-010227-12 800KHz

Ld .101mh	Potcore 14MM	B65541-K0100-A025
	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	30/44 LITZ
	Turns	30

CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-11	A
SCALE	800KHz	SHEET 16	

R1	A. R.
C1	CAP ERIE 538-002-938 7-25pf
C2	A. R.
C3	DURMICA 100V 1% 316pf
XL1	BD-019227-05 1 MHz

L1 .0802mh	Potcore 14MM	B65541-K0100-A025
	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	3/15/44 LITZ
	Turns	27

CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-12	A
SCALE	1 MHZ	SHEET 17	

R1	A. R.
C1	CAP ERIE 538-002-93B 7-25pf.
C2	A. R.
C3	DURMICA 100V. 1% 221 pf.
XL1	BD-010227-16 1.3 MHz

L1	Potcore 14MM	B65541-K0100-A025
.0602mh	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	3/15/44 LITZ
	Turns	24

CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-13	B
SCALE	1.3 MHz	SHEET 18	

R1	A. R.
C1	CAP ERIE 538-002-93B 7-25pf
C2	A. R.
C3	DURMICA 100V 1% 210pf
XL1	BD-010227-31 1.536MHz

L1 .0511mh	Potcore 14MM	B65541-K0100-A025
	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	3/15/44 LITZ
	Turns	22

CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-14	A
SCALE	1.536 KHZ	SHEET 19	

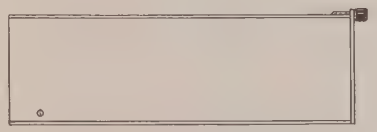
R1	A. R.
C1	CAP ERIE 538-002-93B 725
C2	A. R.
C3	DURMICA 100V 1% 165 pf
XL1	BD-010227-46 1.9 MHz

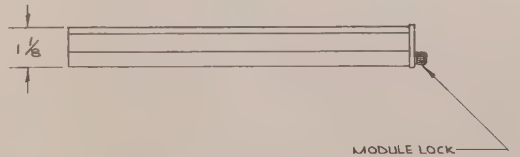
L1 .0425mh	Potcore 14MM	B65541-K0100-A025
	Bobbin	B65542-A0000-M001
	Flange	B65549-J0001-X000
	Mtg. Brkt.	C1408-11 MAG.
	Screw & Core	B65549-A3-X23
	Wire	3/15/44
	Turns	20

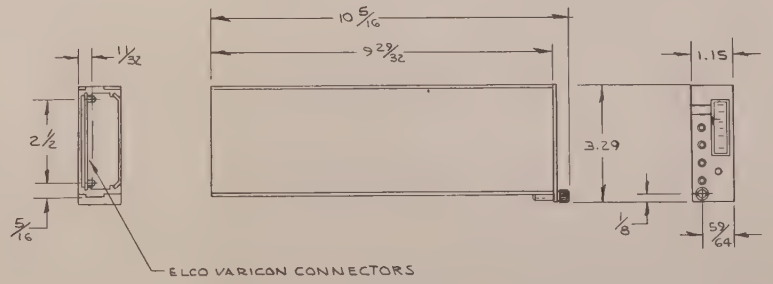
CODE IDENT. NO	SIZE		REV.
08539	A	A-019194-15	A
SCALE	1.9MHZ	SHEET 20	

	TABULATION, PIN CONNECTORS
PIN NO	DESCRIPTION
1	N. C.
2	N. C.
3	N. C.
4	+12V
5	GRD
6	INPUT
7	-12V
8	N. C.
9	+18V
10	N. C.
11	BUFFER OUT 196Ω 160MV
12	GRD.
13	BUFFER IN
14	GRD.
15	SUM OUT 160 MV
16	N. C.
17	50 OHMS OUT 160 MV.
18	GRD.
19	OUT PUT 50Ω 6VPP MAX.
20	GRD

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED







NOTES:

1. THE GXA-1 PLUGS INTO THE DCS MODEL GMA-1 OR GMA-3 MODULE ASSEMBLY. ALL POWER AND SIGNAL CONNECTIONS ARE MADE FROM MODULE ASSEMBLY GXA-1 TO GMA-1 VIA ELCO VARICON CONNECTORS AS TABULATED
2. PIN CONNECTORS ARE NUMBERED FROM TOP TO BOTTOM

QTY REQD	PART OR IDENTIFYING NO.	CODE IDENT.	DESCRIPTION	SPECIFICATION OR VENDOR	SYMBOL	ITEM

LIST OF MATERIALS

REF	DESCRIPTION	QTY

	GXA-1
NEXT ASSY	USED ON

APPLICATION

DIMENSIONS AND TOLERANCES PER MIL STANDARD 8
UNLESS OTHERWISE SPECIFIED
TOLERANCES ON
XXX ± .005 XX ± .010
FRACTIONS ± 1/64 ANGLES
FLATNESS WITHIN
HOLE TOLERANCE PER D C S SPECIFICATION AS-814018, CLASS 1
BREAK ALL CORNERS AND EDGES, REMOVE BURRS .015 MAX

MATERIAL

FINISH

CONTRACT NO

DRAWN	M. SHUELATA	DATE 10/27/69
CHECKED		12-3-69
DESIGNER		
PROJECT ENG	RP	
APPROVED	RP	

APPROVED

APPROVED

DATA-CONTROL SYSTEMS, INC.
DANBURY, CONN.

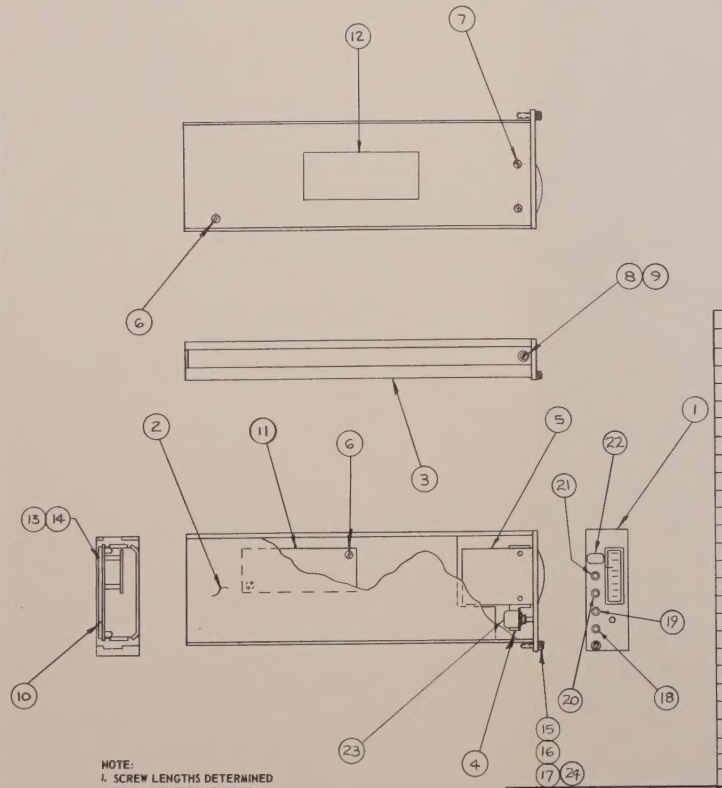
OUTLINE DRAWING GXA-1

SIZE	CODE IDENT	
C	08539	CO-019324-A

SCALE 1/2 SHEET

DATA-CONTROL SYSTEMS CORPORATION Broad Hollow Road Melville, N.Y. REPRODUCTION NO.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	B	ME, REVISED (ADDED ITEMS)	12-9-69	GR/WHJ



NOTE:
1. SCREW LENGTHS DETERMINED PER D.C.S. SPEC AS-832011
2. CEMENT ITEM #14 TO ITEM #3 WITH ITEM #13.

QTY REQD	PART OR IDENTIFYING NO.	CODE IDENT.	DESCRIPTION	SPECIFICATION OR VENDOR	SYMBOL	ITEM
1	AS-826034-16-04		WASHER, NYLON			24
1			POT, AB GA2G0246102UA 1K		R1	23
1	CY-019197		NAMEPLATE			22
1			JACK, SELECTRO SKT-12, GREEN			21
1			BLUE			20
1			RED			19
1			JACK, SELECTRO SKT-12, BLACK			18
1			ROLL PIN, RP-B79-012-062-187			17
1	BD-008924		KNOB, CAPTIVATED			16
1	BD-015477		SCREW, CAPTIVATED			15
1	BD-019327		INSULATOR			14
A/R			ARMSTRONG ADHESIVE, N111			13
1	BD-013361		NAMEPLATE			12
1	AA-019194		BOARD ASSY FILTER			11
1	AA-019193		BOARD ASSY MASTER			10
3	AS-826017-04		WASHER FLAT #4			9
2	AS826028-40		SCREW 4-40 NC-2A PHMS			8
2	AS-826026-26		SCREW 2-56 NC-2A FHMS			7
3	AS-826028-26		SCREW 2-56 NC-2A PHMS			6
1	BD-019148		METER, INDICATOR PANEL			5
1	BD-019319		BRACKET, POT			4
1	CD-019323		CHASSIS			3
1	BD-019989		COVER,			2
1	CF-019321		FAB, FRONT PANEL			1

LIST OF MATERIALS

REF.	DESCRIPTION	QTY.

NEXT ASSY	USED ON
	GXA-1

APPLICATION

DIMENSIONS AND TOLERANCES PER MIL STANDARD 8
UNLESS OTHERWISE SPECIFIED TOLERANCES ON:
.XXX ~ .XX ~
FRACTIONS ~ ANGLES ~
FLATNESS WITHIN ~
HOLE TOLERANCE PER D C S SPECIFICATION AS-814018, CLASS 1
BREAK ALL CORNERS AND EDGES, REMOVE BURRS .015 MAX

MATERIAL —
FINISH —

CONTRACT NO.
DRAWN M SHUFLATA DATE 11/14/69
CHECKED 11-26-69
DESIGNER
PROJECT ENG
APPROVED
APPROVED
APPROVED

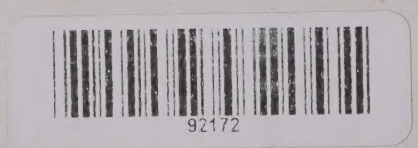
DATA-CONTROL SYSTEMS, INC.
DANBURY, CONN.

FINAL ASSY
GXA-1

SIZE	CODE IDENT.		
C	08539	A 019198	B

SCALE: 1/2 SHEET

DRAFTING MACHINE Graphic Controls Corporation Buffalo, New York Printed in U.S.A. REPROVEL NO. 640M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